METHOD OF DETERMINING AN EFFICIENCY OF A REPAIR PROCESS

RELATED APPLICATION

[0001] The subject patent application is a continuation-in-part application of U.S. Serial No. 09/602,922, which was filed on June 23, 2000.

FIELD OF THE INVENTION

[0002] The present invention relates to a method of determining an efficiency of a production process based on time. In particular, one embodiment of the present invention relates to a method of determining the efficiency of a repair process for one or more vehicles in one or more repair shops based on hours.

BACKGROUND OF THE INVENTION

[0003] Vehicle repair shops or facilities handle a large volume of vehicles. Vehicles remain many days within the shops since the repair process has many time consuming steps. For example in a typical collision repair process, vehicles can undergo a vehicle disassembly step, frame repair step, metal repair step, preparation step, painting step, reassembly step, and testing step. Delays and inefficiencies invariably arise from a number of sources. Exemplary delay sources include incorrect parts being delivered or insurance companies slowly processing vehicle collision claims. Also, inefficiencies can include a repair shop's organizational inefficiencies or a technician's inefficiencies.

[0004] Due to the large volume of vehicles that repair shops handle and the variance in total labor hours to repair each vehicle (degree of damage), managers find it difficult to correctly diagnose what delays and inefficiencies occur enough times to warrant correction. The delays that occur most frequently might be able to be diagnosed. However, delays that occur less frequently escape detection and correction. Further,

many inefficiencies may be masked by the way the repair process is monitored, which is sometimes called cycle time. In particular, repair processes are currently tracked by the number of days, including fractional days, as perceived by the customer, the insurer, and/or the rental car company. If all repair shops worked the same number of hours in a day, then the only way to improve the cycle time would be to improve the efficiency of the actual repair process. However, an emerging trend is for the repair shop to work multiple shifts in a day, work overtime and/or work on Saturdays. The current method of monitoring the repair process can therefore mask inefficiencies by the repair shop. Specifically, the repair shop could work an additional shift, overtime hours in a particular day, or working on a Saturday to seemingly improve efficiency, when in fact these extra shifts/hours may be masking a number of inefficiencies.

[0005] Not only is the diagnosis of vehicle delays and inefficiencies problematic, but it is difficult for an owner of a repair shop to obtain, in a relatively straightforward way, a comprehensive view of how the shop is performing in terms of shop potential, profit potential and other factors relative to other shops, let alone know how it is performing relative to the top vehicle repair shop. Business analysis software packages exist, but are typically not directed to the combination of many specifics (e.g., cycle time analysis, shop shift, process efficiency, and other factors) of a vehicle repair shop, and therefore are less complete. A non-limiting specific example includes the amount of paint used by technicians in the repair process. Typical business analysis software packages are not directed to analyzing the usage of paint and how such usage compares with other shops.

SUMMARY OF THE INVENTION

[0006] One embodiment of the subject invention includes a method of determining an efficiency of a repair process for a vehicle in a repair shop. The method comprises the steps of creating a vehicle identifier for the vehicle. The identified vehicle is examined to locate areas on the identified vehicle in need of repair. An extent of a repair is then estimated for the identified vehicle based on the examination. A total labor hours is estimated to perform the repair process based on the extent of the repair. A vehicle production start period is determined based upon when the repair process of the

identified vehicle begins. Similarly, a vehicle production finish period is determined based upon when the repair process of the identified vehicle ends. A total shop production hours based upon when the repair shop opened and closed for each day between the vehicle production start period and the vehicle production finish period is also determined. This may be affected by overtime on certain days, Saturday operations, or a second shift. A production process efficiency is then calculated for the completed repair process by dividing the total shop production hours by the estimated total labor hours, which reveals a true efficiency of the repair process by calculating the production process efficiency in terms of hours.

[0007] This embodiment of the subject invention therefore overcomes the aforementioned disadvantages as well as other disadvantages. In particular, the method measures the efficiency of the repair process in terms of hours. Hence, while overtime or additional shifts may incorrectly accelerate traditional cycle time measures the efficiency determined by this method will not be affected.

[0008] Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should be understood, however, that the detailed description and specific examples, while indicating different embodiments of the invention, are intended for purposes of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The embodiments of the subject invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

[0010] Figure 1 is a system block diagram depicting a computer-implemented vehicle shop repair analysis system;

[0011] Figure 2 is a software module data flow diagram depicting a data flow among software modules utilized to generate business analysis data;

[0012] Figure 3 is a structure chart depicting a web site architecture of one embodiment of the present invention;

[0013] Figure 4 is a computer screen display depicting a succinct recap of business performance, priorities, projections, and production workforce shift profile that was generated in accordance with the teachings of one embodiment of the present invention;

[0014] Figure 5 is a computer screen display depicting a vehicle tracking and cycle time assessment data processing screen;

[0015] Figure 6 is a computer screen display depicting the display of data associated with sales and marketing data;

[0016] Figure 7 is a computer screen display depicting the entry and display of detailed data associated with sales and marketing data of Figure 6;

[0017] Figure 8 is a computer screen display displaying the result of entering data via the computer screen display of Figure 7;

[0018] Figure 9 is a computer screen display depicting the display of data that was provided via the computer screen of Figure 7;

[0019] Figures 10a and 10b are a computer screen display depicting the entry and display of company financial data, owner's priority data, personnel & shop data, and technician workshift data;

[0020] Figure 11 depicts a computer screen showing how an user's shop compares to other shops in selected measures;

[0021] Figure 12 is a computer screen display depicting a process hours programming guide that includes a data field for weekly set-up of shop production hours and a data field for customer and vehicle data; and

[0022] Figure 13 is a computer screen display depicting the display of data that was entered into the computer screen of Figure 12.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0023] Referring to the Figures wherein like numeral indicate like or corresponding parts throughout the several views, Figure 1 depicts a collision repair shop or facility 30 being connected to a business analysis and transaction computer server 34 via a network such as the Internet 38. The collision repair shop 30 uses the computer server 34 to analyze

the collision repair shop's performance, priorities, business projections, efficiencies and workforce shifts.

[0024] At the collision repair shop 30, a computer 42 provides an interface 46 for a user 50 to communicate with computer server 34. In the preferred embodiment, the computer 42 is situated within the repair shop 30 so that the status of a vehicle can be efficiently tracked as it is being repaired in the shop 30. However, it is to be understood that the embodiments of the subject invention are not limited to the user 50 being only situated within the collision repair shop 30, but also includes a user physically remote from shop 30 but has knowledge of the vehicle's status in the shop 30.

[0025] The user 50 provides financial and other shop-related data so that business analysis module 60, that resides on computer server 34, can analyze the user-provided data. Business analysis module 60 examines user-provided financial, shop, personnel information, and priority assessment data to provide to the user 50 an assessment of the collision repair shop's strengths, weaknesses, areas of opportunities, and business projections. For example, the business analysis module 60 can indicate to the user 50 that based upon the user-provided input data, the shop 30 has an opportunity for growth relative to industry guidelines. The module 60 can also indicate to the user 50 how well the shop 30 is doing relative to the top 25% of all other collision repair shops.

[0026] As another non-limiting example, the business analysis module 60 receives from the computer 42 vehicle repair processing cycle time data. The cycle time data includes not only at what step a vehicle is within the vehicle repair process, but also includes delay reasons and delay time amounts for any delays that have occurred at a step in the repair process. The business analysis module 60 uses the data to identify whether the shop 30 has as one of its strengths a relatively fast time to process a vehicle repair.

[0027] In yet another non-limiting example, the business analysis module 60 receives from the computer 42 various information from the shop in order to calculate a production process efficiency. As is discussed in greater detail below, production process efficiency reveals a true efficiency of a repair process by calculating the production process efficiency in terms of hours.

[0028] The business analysis module 60 also can indicate what equipment the shop 30 can use to actualize opportunities or to overcome weaknesses in one or more areas. A

business transaction module 64 interacts with the business analysis module 60 and the user 50 to automate the process of buying for the user 50 the equipment that would improve the operations of the shop 30. For example, if the business analysis module 60 had identified that the shop 30 has a chronic problem of a shortage of movable carts. The business transaction module 64 is used to identify for the user 50 sellers of movable carts. In this manner, the purchase of needed items is automated for the user 50.

[0029] In one embodiment of the present invention, a paint supply company provides the present invention to the owner of a collision repair shop. Through use by the owner of the module 64 to purchase items, the present invention can recommend products and services offered by the paint supply company, or products and services offered by companies that have co-branded with the paint supply company. The paint supply company providing the present invention also increases loyalty of the owner to the paint supply company even if no non-paint items are ordered.

[0030] Due to the networked environment of the present invention, multiple collision repair shops 56 can use the computer server 34 to analyze and to transact business. However, it should be understood that the embodiments of the present invention can also be given to the users 50 on a computer storage medium (such as a CD-ROM). The user 50 uses the software to analyze and transact business.

[0031] Figure 2 depicts data input and processing performed by the business analysis module 60. A user provides customer financial data 80, customer, shop and personnel information 84, customer assessment of priorities 88, and production shift information 89 in order for the business analysis module 60 to identify best practices 92, analytical worksheets and reports 96, and forms and policies of the business 100. For example, customer financial data 80 can include refinish labor sales and other data items depicted in Figures 10a and 10b shown by reference numeral 80. The customer financial data 80 can also include metal labor hours sold 400, paint labor hours sold 402, and other data items depicted in Figures 12 and 13. Customer, shop and personnel information 84 can include the number of metal stalls including frame and other data items depicted in Figures 10a and 10b shown by reference numeral 84. The customer, shop, and personnel information 84 can also include the total dollars sold 404, the metal labor dollars sold, 406, the paint labor dollars sold 408, and the parts dollars sold 410, as well as other data

items depicted in Figures 12 and 13. Customer assessment of priorities 88 can include prioritizing financial measures and other items depicted in Figures 10a and 10b shown by reference numeral 88. Production shift information 89 can include the number of day shift technicians and other data items depicted in Figures 10a and 10b shown by reference numeral 89. Production shift information 89 may also include the weekly set-up of shop production hours 412 and the customer and vehicle data 414 depicted in Figures 12 and 13.

[0032] The various embodiments of the present invention associate many best practices with the correct form to use. An example of such an association between best practice and the correct form is the efficient capability to track vehicle and cycle time (for example, see Figure 5). By clicking on the form to include it in the shop owner's personal inventory, the shop owner cán create a customized Operations Manual.

[0033] In order to most efficiently and effectively acquire and generate the desired information, a website is provided to the user as depicted in Figure 3. At the top of the structure, is a 20/20 recap web page 120 that provides a succinct presentation of key performance indicators (KPIs), business owner's priorities, financial projections, and the production workforce shift profile associated with the shop. In order to provide the data needed to generate the succinct business presentation, various data input web pages are provided, such as the categories web pages 124 and the update my personal reports web page 128. The category web pages 124 allow the user to enter data into the present invention (see, for example, Figures 6-9 and 12). The update web pages 128 allow the user to customize reports to better fit the particular needs of the user.

[0034] "What if? scenarios" web pages 133 allow the user to examine the effect of changing certain parameters, such as financial parameters, upon the user's shop. A data entry web page 135 allows the user to provide data specifically for the 20/20 recap results summary web page 120. An example of the data entry web page 135 is Figures 10a and 10b.

[0035] Figure 4 depicts a 20/20 recap which is a succinct presentation by this embodiment of the present invention of how well the collision repair shop is doing. Within this embodiment of the present invention, the following areas or their equivalent

are provided: a performance summary 200, a priority summary 204, a projection summary 208, and a production workforce shift profile summary 212.

[0036] The performance summary 200 is generated using a performance data structure with the structure depicted within region 216. The business performance data structure includes selected key performance indicators, facility/shop data, industry guidelines, a top 25% indicator, and whether opportunities exist to improve the business. For example, a key performance indicator within data structure 216 includes a production proficiency amount for the shop, industry guidelines, and top 25% indicator. As another example, total gross profit percent is provided for the shop, industry guides, and top 25%. An opportunity in this example has been identified by this embodiment of the present invention that the user's shop has a total gross profit percent of 38.5% which is below the 40.0% industry guideline and well below the top 25% value of 43.5%. An opportunity indicator 220 is generated for the user to explicitly show that the user's shop can grow in this area in order to be more competitive relative to other shops. Specific aspects of the shop, such as paint, can be studied and analyzed. For example, monthly paint gallons of waste per paint technician is provided as an indicator for the user to review.

[0037] As another example, opportunity indicator 222 is generated for the user to explicitly show that based upon the shop's monthly sales and number of staff employees the user's shop can most likely generate additional profits without adding staff.

[0038] In one embodiment, performance data structure 216 includes the following indicators: annualized total sales amount, total gross profit percent, production proficiency, production staffing density (main shift), monthly sales per administrative employee, monthly sales per estimator, paint cost per paint hour billed, monthly gallons waste per paint technician, overall customer satisfaction index, and gross profit dollar amount per technician clock hour.

[0039] With selected performance indicators such as proficiency and staffing density, the user sees a spectrum of actual values and the shop's position on the spectrum. The user is neither intimidated by group averages that are high nor stifled by a low target. The user will find the performances of real shops at the shop owner's current performance and at any level of performance considered.

[0040] For example, Figure 11 depicts a computer screen showing how an user's shop compares to other shops, and not just how the user's shop compares with the top 25% of all shops. In this example, column 237 on Figure 11 depicts that the user's shop is above average for technician production efficiency relative to other shops as shown by reference numeral 241. Column 239 depicts that the user's shop is below average for stalls per technician (main shift only) as shown by reference numeral 243.

[0041] With reference back to Figure 4, a business priorities data structure is depicted within region 240 in order to store and to display business priority information relevant to the user's shop. The business priorities data structure 240 includes business areas and indicators as to how strong the shop is within the areas. For example, a priority as selected by the user is the financial performance of the shop. Based upon the user's financial input data in this example, the financial performance of the shop is indicated as being relatively weak by the owner as shown by the strength indicator 244. If the user wanted to see the data and the calculation methods by which the key performance indicators 200 were generated, the user clicks upon tab 248 to obtain greater detail about the data used to generate the performance indicators 200. In the preferred embodiment, owner priorities data structure 240 includes financial measures, financial performance, sales and marketing, customer satisfaction index, and insurance relations including cycle time, administration (general), administration (parts), production (general), production (refinish), shop (capacity, equipment, layout), and personnel including pay plans and incentives.

[0042] Projections summary 208 uses a data structure 250 to handle the projections data associated with the shop. The data structure 250 includes performance factors, sales, gross profit, the additional amount of gross profit that would be generated given a certain level of improvement. The projections data structure 250 allows the user to pose "what if" scenarios for assessing how much improvement the user shop would experience given different situations.

[0043] For example, the second performance factor in projections data structure 250 is directed to posing a "what if" scenario of what would be the increase in profits with a 10% improvement in production proficiency. Based upon the user's supplied input data, the projections module determines that with the a 10% improvement in production

proficiency, the gross profit of the shop would be improved by $24,000 with sales of $1,470,000 and a gross profit of $540,000.

[0044] In one preferred embodiment, the projections data structure 250 includes the following performance factors: current performance (annualized), "with 10% improvement in production efficiency", "performance with one additional technician", "with 10% improvement in parts:labor ratio", "with 2% improvement in labor gross profit", "with 2% improvement in parts gross profit", "with 2% improvement in materials gross profit", and "with cumulative impact of all improvements".

[0045] A production workforce shift profile summary 212 is generated using a production workforce data structure 260 that includes main shift only data, main shift plus overtime or Saturday data, main shift and second shift data, and main shift, second shift, and Saturday data. Within the summary 212, the dark portions 264 indicate that the shop has a main shift plus an overtime shift, while the lighter portions 268 indicate that there is not a second shift nor a Saturday operations shift. This embodiment of the present invention utilizes within the data structure 260 a breakout of the main shift from the other shifts, such as the second shift. In this manner, the present invention is better able to assess shop utilization and potential for greater shop utilization. By the present invention's identifying main shift employees separately from second shift employees, the shop owner can not only obtain a better perspective of the utilization of the shop, but also have a more practical evaluation of actual stalls per technician for the primary shift.

[0046] As discussed in greater detail below with reference to Figures 12 and 13, another embodiment of the subject invention can also determine the efficiency of a repair process for a shop such that the shop can determine ways to improve. The efficiency can be evaluated internally and/or evaluated against other competing shops.

[0047] If the user wanted to see how the data was generated or to input new data into the business analysis module 60, the user identifies within priority summary section 204 which priority detail needs examination. As an example, if the user wanted to enter in data for the first time relative to "insurance relations including cycle time", which is the fifth priority within summary section 204, the user clicks upon tab button 272. Upon clicking tab button 272, the user is directed to the insurance and cycle time area which would include the computer screen of Figure 5. Alternatively, as discussed in greater

detail below, the user could be directed to the process hours programming guide which would include the computer screen of Figure 12.

[0048] Referring to Figure 5, this embodiment depicts a data entry and data display computer screen related to vehicle tracking and cycle time measurements and assessments. This embodiment of the present invention uses data structure 304 with the attributes listed in row 300 or equivalents thereof.

[0049] The cycle time data structure 304 includes a vehicle identifier to uniquely identify a vehicle that is undergoing a repair process. For example, the vehicle can be identified by an unique repair number supplied by the shop, a customer name, vehicle brand, vehicle year, and beginning date of the repair.

[0050] The data structure 304 also includes the steps which the vehicle is to undergo for repair. If the repair is due to a vehicle accident which would include a vehicle frame reconstruction and repainting, then typical repair steps include the vehicle disassembly step, frame repair step, metal repair step, preparation step, painting step, reassembly step, and testing step. The data structure 304 not only tracks what step a vehicle is presently at but also includes whether a vehicle remains at a step for time greater than a predetermined amount. In the preferred embodiment, codes as shown in region 308 are placed at a step where a delay has occurred. For example, a "P1" code is used to indicate that the reason for delay was that there was a delay in delivery of the parts. A number preceding the code indicates the amount of time associated with the delay. In the preferred embodiment, the number indicates the additional days of delay, such as, for example, "2P2" indicates that there was a two day delay at a particular step due to incorrect parts being delivered. Accordingly, if for a vehicle at the frame repair step the code "2P2" appears, this indicates that there was a delay for two days for a vehicle where the frame could not be operated upon due to incorrect parts being delivered.

[0051] If a particular shop receives an inordinate amount of code "P2's", then this would indicate that there is a chronic problem of incorrect parts being delivered, possibly for example from a single source for a single brand of vehicle. This delay would adversely affect the strength indicator for cycle time and would also indicate that the problem could be addressed such as by possibly ordering parts from another supply shop for vehicles of that brand.

[0052] In this embodiment, the present invention also includes the source category of the parts, such as whether the parts category is an OEM (original equipment manufacturer) parts category, or an after market parts category, or a salvage parts category, or other types of parts category. Another embodiment includes using additional attributes to store the source category of the parts.

[0053] The data structure 304 includes the date upon which the vehicle's repair was completed as well as the final total amount expended to perform the repair. Thus, the data structure 304 not only tracks the vehicle through a multi-step process, but also performs cycle time measurement by noting the amount of time of delay. This embodiment of the present invention performs cycle time analysis by providing the reason for the delay.

[0054] In one embodiment, when a car enters each step, a symbol such as a " --" is entered in the data structure 304. Each day, all vehicles in the vehicle repair shop are reviewed. If a vehicle has been worked upon for at least five hours, then nothing additionally is noted for the vehicle in the data structure 304. However, if less than five hours has been expended for working upon a car, then the reason for the delay as well as the current delay time amount is entered into the appropriate step in the data structure 304.

[0055] The data structure 304 also includes target analysis where desired target time repair values are compared against the actual time expended to repair a vehicle. In the preferred embodiment, the target analysis includes the number of labor hours sold, the labor hours divided by five hours, actual business days expended to repair the vehicle, and a cycle time efficiency metric. For example, if the number of labor hours sold to complete a vehicle repair process was 30 hours, the labor hours divided by 5 value would be 6. If the actual days expended was 7 instead of the targeted six days, then the cycle time efficiency would indicate that 1 day had been lost .

[0056] The data structure 304 includes the insurance company being associated with a vehicle repair in order to capture delays associated with an insurance company. For example, if an inordinate number of "I1" insurance approval delay codes have been entered in the data structure 304 for a particular insurance company, then the owner of the vehicle can be told that the reason for the delay was not the repair shop, but rather the

insurance company that the vehicle's owner presently uses and that this insurance company is chronically late inspecting damaged vehicles.

[0057] Figure 6 provides an example of an user entering and viewing the detailed information used to generate sales and marketing summary information. In particular, Figure 6 is associated with the selling and sources of the business. This embodiment of the present invention provides multiple areas in this category for the user to provide information about their business. For example, the present invention asks for information related to a customer's first impression of the user's shop. A user clicks upon button 350 via a pointing device (such as a computer mouse) to see more detailed questions asked by the present invention as well as have access to an action planner for adding particular checklist items to the user's business plan. Upon clicking button 350, the user in this example is taken to the computer screen depicted in Figure 7.

[0058] With respect to Figure 7, more detailed questions are asked about the user's shop. For example, regarding the customer's first impression of the shop, more detailed information is gathered via region 380. Questions include but are not limited to the user ranking overall impression of the shop from the street as being nonapplicable, weak, average or strong. Even more detailed questions may be asked regarding the overall impression by focusing the user upon the shop's signage, general appearance of the building and whether the shop has a clear and wide entrance. If the user deems necessary, such as if the user upon reflection believes that one or more of these questions indicate a weakness, the user can select to add this particular question to a 90-day business plan of the shop or add it to a one-year business plan of the shop. It should be understood that the present invention also includes the present invention allowing the user to bypass Figure 6 and proceed directly to the detailed questions of Figure 7.

[0059] Figure 8 provides an example of generating results after the user has provided information to the questions presented in Figure 7. For example, the signage question produced a weak response, the general appearance of the building produced a relatively strong response, while the clear and wide entrance question produced a very weak response. These responses as well as the other responses associated with the questions of region 380 contributed to a customer's first impression of the shop as being weak as

shown by reference numeral 384. The user selected both the signage as well as clear and wide entrance questions to be added to the 90-day business plan.

[0060] Figure 9 shows the same computer screen as Figure 7, however populated with information supplied by the user. The results of the responses supplied by the user on Figure 9 shows the strength indicator relative to the customer's first impression of your shop by reference numeral 384. In this example, the user has supplied other information that is used to generate the strength indicators for the remaining business aspects in Figure 9.

[0061] Figures 10a and 10b show another example of the present invention acquiring data in order to provide business analysis to the user. The computer screen depicted in Figures 10a and 10b shows a customer data entry form for providing detailed information about the user as well as sales information and how many technicians work, on which days, for how many hours, and for which shift. This information is aggregated by and shown to the user in the succinct format depicted in Figure 4.

[0062] Turning to Figures 12 and 13, another embodiment of the subject invention is now discussed in greater detail. In particular, these Figures depict a computer screen display for a process hours programming guide. Figure 12 depicts a blank screen and Figure 13 depicts a partially filled-in screen. This process hours programming guide is utilized to determine an efficiency of a repair process for a vehicle in a repair shop. There are three main data fields included in the process hours programming guide. One of the fields is the weekly set-up of shop production hours 412. This shop production hours data field 412 includes a separate row for each day of the week. The shop production hours data field 412 also includes a column for the month and day, a column for a start time (a.m. and p.m.), and a column for a finish time (a.m. and p.m.). There is also an end of week data field 416 that includes total body clock hours, total helper clock hours, and total paint clock hours for the week.

[0063] The final main data field is the customer and vehicle data field 414 that has a plurality of rows. Each vehicle is placed on a separate row such that the number of rows being utilized will depend on the number of vehicles at the shop being repaired. The customer and vehicle data field 414 has a number of columns, some of which have already been discussed. In particular, the customer and vehicle data field 414 includes a

vehicle identifier 418 to uniquely identify the vehicle that is undergoing the repair process. As illustrated, the vehicle identifier can be defined as one or more of a customer identifying data 420, an estimator data 422, a repair order data 424, an insurance source data 426, a vehicle brand data 428, and/or a vehicle year data 430. The customer identifying data 420 could be the customer's name and, similarly, the estimator data 422 could be the estimator's name. Also, the vehicle brand data 428 could be the vehicle make and model.

[0064] The customer and vehicle data field 414 also includes data relating to the dollars and hours sold. In particular, the total dollars sold 404, the metal labor dollars sold 406, the paint labor dollars sold 408, and the parts dollars sold 410 are all separately tracked. Further, the metal labor hours sold 400 and paint labor hours sold 402 are also independently tracked. As discussed in greater detail below, this data relating to the dollars and hours sold is inputted into the programming guide after an estimate of an extent of a repair is performed. A supplement data field 432 is provided such that additional data relating to hours and/or dollars sold can be inputted if hidden repairs are discovered after the estimate has been completed.

[0065] As discussed in greater detail above, the repair process can include performing one or more of a disassembly step, a frame repair or reconstruction step, a metal repair step, a preparation step, a painting step, a reassembly step, a testing step, and a detailing step. These steps of the repair process are what defines the metal 400 and paint 402 hours sold, which in turn defines the metal 406 and paint 408 labor dollars sold. Specifically, the ____, _____, and metal repair step define the metal hours sold. Further, the ____, _____, and painting step define the paint hours sold. It should be appreciated that there may be any suitable number of steps performed during the repair process and any suitable number of categories for the hours and dollars sold.

[0066] The customer and vehicle data field 414 also includes date and time data for the vehicle. In particular, the date in which the vehicle is delivered to the shop 434 and the date in which the vehicle is delivered back to the customer 436 are tracked. The delivery date to the shop 434 is labeled as "Date Keys In" and the delivery date back to the customer 436 is labeled as "Date Veh Del" in Figures 12 and 13. Also, a vehicle production start period 437 and a vehicle production finish period 441 are monitored.

Preferably, the vehicle production start period 437 includes the date and time that the repair process, or production process, starts 438, 440. Frequently there is a delay, usually one day, between the date that the vehicle is delivered to the shop 434 and the date that the repair process starts 438. Similarly, the vehicle production finish period 441 includes the date and time that the repair process, or production process, finishes 442, 444. There is also frequently a delay, usually one day, between the date that the repair process is finished 442 and the date that the vehicle is delivered back to the customer 436.

[0067] This embodiment of the present invention also provides a code delay 446 which signifies a reason for a delay, if any. The codes are discussed in greater detail above and are set forth in Figure 5.

[0068] The specific method of determining the efficiency of the repair process for the vehicle in the repair shop is now discussed in greater detail with continued reference to Figures 12 and 13. The vehicle identifier 418 is created for each vehicle in the repair process and inputted into the customer and vehicle data field 414. As discussed above, the vehicle identifier 418 can be any number of selected items and typically data for each item is inputted. The vehicle is usually tracked through the repair process by the repair order number 424. The identified vehicle is examined to locate areas on the identified vehicle in need of repair. This examination is typically preformed at the shop by an estimator. An extent of a repair for the identified vehicle based on the examination is then estimated. The extent of the repair identifies how involved or complicated the repair process will be. The estimator attempts to determine the number of steps required in the repair process taking into consideration industry standards for the specific type of repair. As is well known in the vehicle repair industry, there are a number of industry standards for virtually any type of repair. The industry standards are compiled and formulated based on years of experience in performing similar repairs.

[0069] A total labor hours to perform the repair process based on the extent of the repair is now estimated. As discussed above, the estimated total labor hours can be a combination of various categories of labor hours including total metal labor hours plus total paint labor hours. As with the repair process steps, the labor hours to perform the repair process are likewise standardized. In other words, for each step in the repair

process there is a standard number of labor hours that a shop should be able to compete this step. Also, insurance companies will typically not pay more than these standarized labor hours for a particular step. The step of estimating the total labor hours to perform the repair process is further defined as estimating a total labor hours to be sold to perform the repair process. The standard labor hours to be sold, such as the metal labor hours sold 400 and the paint labor hours sold 402, are inputted into the appropriate columns in the customer and vehicle data field 414. Based on the labor hours to be sold, the total dollars sold 404, metal labor dollars sold 406, and paint labor dollars sold 408 can be determined and inputted into the appropriate columns in the customer and vehicle data field 414. The estimator also estimates the parts needed for the repair. The parts dollars sold 410 can then be determined and inputted into the customer and vehicle data field 414.

[0070] As mentioned above, the vehicle production start period 437, based upon when the repair process of the identified vehicle begins, is determined. Preferably, the repair process of the identified vehicle begins when a predetermined event occurs within the repair shop. Hence, the step of determining the vehicle production start period 437 is further defined as determining the vehicle production start period 437 based upon when the predetermined event occurs. Even more preferably, the predetermined event is further defined as a technician being assigned to the identified vehicle. As such, the step of determining the vehicle production start period 437 is further defined as determining the vehicle production start period 437 based upon when the technician is assigned to the identified vehicle.

[0071] As also mentioned above, the vehicle production finish period 441, based upon when the repair process of the identified vehicle ends, is also determined. Preferably, the repair process of the identified vehicle ends when a predetermined event occurs within the repair shop. Hence, the step of determining the vehicle production finish period 441 is further defined as determining the vehicle production finish period 441 based upon when the predetermined event occurs. Even more preferably, the predetermined event is further defined as a technician being unassigned to the identified vehicle. As such, the step of determining the vehicle production finish period 441 is further defined as

determining the vehicle production finish period 441 based upon when the technician is unassigned to the identified vehicle.

[0072] In-between the vehicle production start period 437 and the vehicle production finish period 441, the repair process is being performed on the identified vehicle. As discussed repeatedly above, the repair process can include performing one or more of a disassembly step, a frame repair or reconstruction step, a metal repair step, a preparation step, a painting step, a reassembly step, a testing step, and a detailing step. There may, of course, be any additional steps performed during the repair process as desired.

[0073] In the preferred embodiment, the vehicle production start period 437 is further defined as having a vehicle production start date 438 and a vehicle production start time 440 based upon a date and time that the repair process of the identified vehicle begins. Similarly, the vehicle production finish period 441 is further defined as having a vehicle production finish date 442 and a vehicle production finish time 444 based upon a date and time that the repair process of the identified vehicle ends. Hence, in the preferred embodiment, the periods 437, 441 for the vehicle production start and finish are determined by date and time. It should be appreciated, that the periods may be any number or combination of data as desired. The days between the vehicle production start date 438 and time 440 and the vehicle production finish date 442 and time 444 can then be calculated to determine a number of days for a total vehicle production. The data of the total vehicle production in days is not critical to the subject invention but can be useful information when producing certain reports.

[0074] A total shop production hours based upon when the repair shop opened and closed for each day between the vehicle production start period 437 and the vehicle production finish period 441 is next determined. Preferably, the step of determining the total shop production hours is further defined as determining the total shop production hours based upon when the shop opened and closed for each day between the vehicle production start date 438 and time 440 and the vehicle production finish date 442 and time 444. As such, the data from both the shop production hours 412 and the customer and vehicle data 414 are used.

[0075] Preferably, the step of determining the total shop production hours is further defined as determining a shop start period equal to the vehicle production start period

437 and determining a shop finish period equal to the vehicle production finish period 441. In the most preferred embodiment, the step of determining the total shop production hours is further defined as determining a shop start date and time equal to the vehicle production start date 438 and time 440, respectively, and determining a shop finish date and time equal to the vehicle production finish date 442 and time 444, respectively.

[0076] In order to calculate the total shop production hours, the number of days between the shop start period and the shop finish period is determined. Preferably, the number of days between the shop start date and the shop finish date is determined. If the number of days between the shop start period, preferably the shop start date, and the shop finish period, preferably the shop finish date, is equal to one day, then the step of determining the total shop production hours is further defined as calculating the number of hours between the shop start period, preferably the shop start time, and the shop finish period, preferably the shop finish time. This data, i.e., the number of hours in one day, can be calculated from the shop production hours data field 412.

[0077] If the number of days between the shop start period and the shop finish period is equal to two days, then the step of determining the total shop production hours become slightly more complicated. First, the number of hours between the shop start period and a shop closing time for a first day is calculated to define the first day period. Next, the number of hours between a shop opening time for a second day and the shop finish period is calculated to define the second day period. In the preferred embodiment, the number of hours between the shop start time and a shop closing time for a first day is first calculated to define the first day period. Next, the number of hours between a shop opening time for a second day and the shop finish time is calculated to define the second day period. In either case, the hours of the first day period are then added to the hours of the second day period to determine the total shop production hours. This data, i.e., the number of hours in two days, can be calculated from using both the shop production data field 412 and the customer and vehicle data field 414.

[0078] If the number of days between the shop start period and the shop finish period is greater than two days, then the step of determining the total shop production hours includes even further steps. First, the number of hours between the shop start period and

a shop closing time for a first day is calculated to define a first day period. Next, the number of hours between a shop opening time for a last day and the shop finish period is calculated to define the last day period. Then the number of hours between shop opening and closing times for each day between the first and last day periods are calculated to define the middle day period. In the preferred embodiment, the number of hours between the shop start time and a shop closing time for a first day is first calculated to define the first day period. Next, the number of hours between a shop opening time for a last day and the shop finish time is calculated to define the last day period. Then the number of hours between shop opening and closing times for each day between the first and last day periods are calculated to define the middle day period. In either case, the hours of the first day period, the middle day period, and the last day period are added together to determine the total shop production hours. This data, i.e., the number of hours in more than two days, can be calculated from using both the shop production data field 412 and the customer and vehicle data field 414.

[0079] A production process efficiency for the completed repair process is calculated by dividing the total shop production hours by the estimated total labor hours. This calculation reveals a true efficiency of the repair process by calculating the production process efficiency in terms of hours. The production process efficiency can also be averaged for a number of repair processes as is discussed below.

[0080] The steps outlined above can be repeated for a plurality of identified vehicles each having a separate repair process in the same repair shop. An average of the estimated total labor hours can also be calculated for the plurality of identified vehicles in the same repair shop. Similarly, an average of the total shop production hours can be calculated for the plurality of identified vehicles in the same repair shop. As such, an average of the production process efficiency can be calculated for the repair processes by dividing the average total shop production hours by the average estimated total labor hours.

[0081] The steps outlined above can also be repeated for a plurality of identified vehicles each having a separate repair process in a plurality of different repair shops. In this instance, an average of the estimated total labor hours is calculated for the plurality of identified vehicles in the plurality of different repair shops. Similarly, an average of the

total shop production hours is calculated for the plurality of identified vehicles in the plurality of different repair shops. As such, an average of the production process efficiency is calculated for the repair processes by dividing the average total shop production hours by the average estimated total labor hours.

[0082] Referring specifically to Figure 13, data has been entered into the computer screen of Figure 12. Specifically, the weekly set-up of shop production hours data field 412 includes representative data for Monday September 8^{th} through Friday September 12^{th}. In this example, the shop opened at 8 a.m. each day and closed at 5 p.m. each day except for Thursday. On Thursday, the shop was did not close until 9 p.m.

[0083] The customer and vehicle data field 414 includes three representative vehicles that are identified as "Ex 1", "Ex 2", and "Ex 3". Both Ex 1 and Ex 2 have a total hours sold of eighteen, which includes ten metal hours sold 400 and eight paint hours sold 402. Ex 3 has a total hours sold of twenty-one with twelve metal hours sold 400 and nine paint hours sold 402. The number of days of total vehicle production for Ex 1 and Ex 2 is 2.25 days. The number of days of total vehicle production for Ex 3 is 2.00 days. Hence, the cycle time, discussed above, is the same for the Ex 1 and Ex 2 and is less for Ex 3. This would seem to imply that Ex 1 and Ex 2 are operating at the same efficiency and that Ex 3 is operating at 12.5% greater efficiency. As is discussed below, the production process efficiency, which is calculated by using the method of the subject invention, proves that this is not the case. Consider the following chart for Ex 1, Ex 2 and Ex 3;

vehicle identifier	total vehicle production (in days)	total shop production hours	total labor hours sold	production process efficiency
Ex 1	2.25	18	18	100%
Ex 2	2.25	22	18	82%
Ex 3	2.00	20	21	105%

(The total shop production hours assumes a 12 noon to 1 p.m. lunch break)

[0084] The production process efficiency reveals that the repair process for the Ex 2 vehicle was significantly less efficient than the repair process for either the Ex 1 or Ex 3.

This inefficiency is due to the extended shop production hours on Thursday. The production process efficiency also reveals that the repair process for the Ex 3 vehicle was only 5% more efficient than the repair process of the Ex 1. This is also due to the extended shop production hours on Thursday. However, extended shop production hours are not necessarily a negative factor, if evaluated properly. In Ex 3, the shop was able to complete the repair process within the total labor hours that can be sold. Specifically, the total labor hours sold is greater, by one hour, than the total shop production hours. This difference accounts for the extra 5% in efficiency, even with the extended shop production hours.

[0085] The customer and vehicle data 414 for Ex 1, Ex 2, and Ex 3 can also be used to calculate various averaged data. For example, the average total shop production hours equals twenty and the average total labor hours sold equals nineteen. Hence, the average production process efficiency for the repair processes of Ex 1, Ex 2, and Ex 3 equals 95%. These calculations are the same whether the repair processes for Ex 1, Ex 2, and Ex 3 are done at the same or different shops.

[0086] The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention and all such modifications that would be obvious to one skilled in the art are intended to be included within the scope of the following claims. For example, the present invention is not limited to vehicle collision repair shops, but extends to other multi-process vehicle operations or multi-process non-vehicle operations, such as but not limited to vehicle sales operations. For example, a vehicle sales operation shop uses the present invention to analyze its business relative to performance, priorities, projections, and production workforce shift profiles.